Bristol

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Municipal Resilience Program

Community Resilience Building Workshop

Summary of Findings

August 2020

Town of Bristol
Community Resilience Building Workshop
Summary of Findings

Overview

The need for municipalities, regional planning organizations, states and federal agencies to increase resilience and adapt to extreme weather events and a changing climate is strikingly evident amongst the communities of the state of Rhode Island. Recent events such as Tropical Storm Irene and Sandy have reinforced this urgency and compelled leading communities like the Town of Bristol to proactively collaborate on planning and mitigating risks. Ultimately, this type of leadership is to be commended because it will reduce the vulnerability and reinforce the strengths of people, infrastructure, and ecosystems and serve as a model for other communities across Rhode Island, New England, and the nation.

In the spring of 2020, the Town of Bristol embarked on certification within the newly established state of Rhode Island's Municipal Resilience Program (MRP). As an important step towards certification, Rhode Island Infrastructure Bank (RIIB) and the Nature Conservancy (TNC) provided the Town with a community-driven process to assess current hazard and climate change impacts and to surface projects, plans, and policies for improved resilience. In July 2020, Bristol's Core Project Team organized a Community Resilience Building Workshop lead by TNC in partnership with RIIB. The core directive of this effort was the engagement with and between community stakeholders to defein strength and vulnerabilities and the education, planning and ultimately implementation of priority resilience actions for Bristol.

The Bristol Community Resilience Building Workshop's central objectives were to:

- Define top local natural and climate-related hazards of concern;
- Identify existing and future strengths and vulnerabilities;
- Identify and prioritized actions for the Town of Bristol;
- Identify opportunities to collaboratively advance actions to increase resilience.

The Town of Bristol employed a unique "anywhere at any scale", community-driven process known as Community Resilience Building (CRB) (www.CommunityResilienceBuilding.org). The CRB's tools and various reports, and maps were integrated into the workshop process to provide both decision-support and visualization around shared issues and priorities across Bristol. The Bristol Natural Hazard Mitigation Plan (2016), Comprehensive Plan (2016), and Chapter 1 of Resilient Rhody where particularly instructive. Using the CRB process, rich with information, experience and dialogue, the participants produced the findings presented in this summary report including an overview of the top hazards, current concerns and challenges, existing strengths, and proposed actions to improve Bristol's resilience to hazards and climate change today, and in the future.

The summary of findings transcribed in this report, like any that concern the evolving nature of risk assessment and associated action, are proffered for comments, corrections and updates from workshop attendees and other stakeholders alike. The leadership displayed by the Bristol on community resilience building will benefit from the continuous and expanding participation of all those concerned.

Summary of Findings

Top Hazards and Vulnerable Areas for the Community

Prior to the CRB Workshop, the Core Project Team identified the top hazards for Bristol. The hazards of greatest concern to the participants was major storms including hurricanes, Nor'easters, and winter/ice storms as well as drought and heatwaves. The other key hazards discussed included precipitation-driven flooding (inland and riverine), coastal flooding and inundation (storm surge and sea level rise), and heavy wind events. These hazards have direct and increasing impacts on Bristol's residents and resources, such as its neighborhoods, natural areas (rivers, wetlands, shorelines, beaches, salt marshes), roads, bridges, tourism, municipal facilities, social support service for disproportionately disadvantaged populations, and other critical infrastructure and community assets.

Top Hazards and Areas of Concern for the Community

Top Hazards

- Hurricanes
- Flooding (Coastal & Inland)
- Droughts & Heatwaves

Areas of Concern in Bristol* - Several categories and locations were identified as being particularly vulnerable by workshop participants including:

Infrastructure: Seawalls (associated with roads (e.g. Poppasquash Road)), Stormwater System, Sewer System (including Sanitary Sewer Lines), Wastewater Management (e.g. Bristol Wastewater Treatment Facility), Water Utilities (e.g. transmission line), Town Beach, Evacuation Route, Schools and Universities (e.g. Roger Williams University, Mt. Hope High School), Bristol Golf Course, Bristol Harbor, Prudence Island Dock, Marina, Electrical Grid, Emergency Shelters, Gas Line, Cemetery, Historic Buildings, Green Stormwater Infrastructure, Mt. Hope High School Fields, Shopping Centers (Gooding Plaza Shopping Center, Stop & Shop), Police Station Parking Lot, Independence State Park Boat Ramp, Sea Walls, Historical Buildings.

Ecosystems: Silver Creek, Tanyard Brook, Trees (live, dead, and standing near power lines), Salt Marshes (current and future advancement zones, algal blooms), Beaches (e.g. Town Beach, Walley Beach), Parks (e.g. Independence Park, Colt State Park), High Groundwater Levels, Wetland Habitats (Bristol Golf Course), Sunrise Drive (end-of-road retrofit).

Roads, Bridges, and Road Network: Rt. 114, Poppasquash Road, Thames Street, Chestnut Street, Tupelo Street, Metacom Avenue, Fails Road, Bike Paths, Low-Lying Roads (prone to flooding), Bridges (e.g. Mt. Hope Bridge, Silver Creek Bridge).

Neighborhoods/Areas: Downtown area, Historic District, Wood Street Neighborhood, Benjamin Church Manor, Veteran's Home, Nursing Homes, Silver Creek area, Hope Street Area.

Vulnerable Populations: Elderly/Senior Citizens, Special Needs, Disabled, Roger Williams University Students, Visitors and Tourists, Local Business Owners, Veterans, Low-Income Residents, Working Waterfront Community.

*Information from workshop participants augmented with the Bristol NHMP (2016). See Appendix A for full list of vulnerable assets and associated mitigation actions from the Bristol NHMP (i.e. Table 2.1 & Section 4.3).

Current Concerns and Challenges Presented by Hazards

The Town of Bristol has several concerns and faces multiple challenges related to the impacts of natural hazards and climate change. In recent years, Bristol has experienced a series of highly disruptive and damaging weather events including March 2010 floods, Tropical Storm Irene (August 2011), Super Storm Sandy (October 2012), winter Nor'easter Nemo (February 2013), and other less impactful but more frequent events. Impacts from Irene included heavy, rain-induced, inland flooding and wind damage. Sandy caused extended coastal erosion and extended power outages across portions of Bristol. The winter storm Nemo dropped 19-20" of snow on the Town knocking out power and isolating residents and neighborhoods due to extended road closures. The magnitude and intensity of these events and others across Rhode Island has increased awareness of natural hazards and climate change, while motivating communities like Bristol to proactively and comprehensively improve resilience.

This series of extreme weather events highlights that for Bristol the impacts from hazards are diverse; ranging from coastal flooding of critical infrastructure, bridges, roads, and low-lying areas near coast and inland during intense storms and heavy precipitation events to property damage from trees, wind, snow, and ice. Longer periods of elevated heat, particularly in July and August, have raised concerns about vulnerable segments of the population including the elderly and disabled. The combination of these issues presents a challenge to preparedness and mitigation priorities and requires comprehensive yet tailored action for particular locations and/or areas across Bristol.

The workshop participants were generally in agreement that Bristol is experiencing more intense and frequent storm events and heat waves. Additionally, there was a general concern about the challenges of being prepared with contingency plans for worst case scenarios (i.e. major disasters, storms, major hurricanes (Cat-3 or above)) during different times of the year, particularly in the fall/winter months due to more intense storms.

(Credit: en.wikipedia.org)

(Credit: explorebristolri.com)

(Credit: abc6.com)

Specific Categories of Concerns and Challenges

As in any community, Bristol is not uniformly vulnerable to hazard and climate change, and certain locations, resources, and populations have and will be affected to a greater degree than others. Workshop participants identified the following items as their community's key areas of concern and challenges across three categories - Infrastructure, Societal, and Environmental.

Infrastructure Concerns and Challenges

Roads, Bridges, and Road Networks:

- Low-lying coastal roads and roads in close proximity to riverine systems subjected to erosion and routine flooding from storm surge and stormwater runoff. (i.e. Silver Creek area).
- Limited transportation and evacuation routes that are vulnerable to flooding - only two north/south routes in and through Town.
- Evacuation/escape options via bridges (i.e. Mt. Hope Bridge closes during storms and high winds).

Stormwater Management:

- Old and decaying drainage system unable to keep up with current levels of flooding, not to mention projections for more intense and longer duration storms.
- Key watersheds prone to flooding (i.e. Silver Creek and Tanyard Brook).

Water Supply:

- Vulnerability of the water supply line - the Town's only source of drinking water.

Septic Systems:

- Privately owned and maintained on-site wastewater treatment subject to flooding in high flood and high groundwater areas (i.e. Poppasquash, Monkey Wrench).

Emergency Management and Preparedness:

- Need to update and revisit evacuation routes.
- Communications and assistance effectively reaching the majority of residents during a major event - particularly those with special needs and mobility issues, as well as the elderly.

Housing:

- Direct impacts to structures from storms - flooding coupled with wind.
- Isolation of homes when road network is compromised for extended periods.
- Education about potential for current and future impacts to structures.

Specific Categories of Concerns and Challenges (cont'd)

Societal Concerns and Challenges

Vulnerable Populations:

- Implications to local residents and visitors in neighborhoods susceptible to flooding and isolation due to compromised/limited access and egress (i.e. elderly, working poor, disabled individuals, veterans).
- Implications on disproportionately disadvantaged populations (i.e. elderly, working poor, and others) due to flooding, winter storms, and heat waves.
- Need for more business continuity planning and recovery support.

Power:

- Power outages to residential homes and businesses particularly during the winter months increasing isolation and risks to key groups such as elderly and working poor families.
- Power outages in Providence can cut off power to the entire East Bay highlighting the interconnectedness of the electrical grid in Bristol.

Historic Areas:

- Historic resources and sites located in floodplains.

Environmental Concerns and Challenges

Groundwater:

- High groundwater levels pose risks to homes and businesses placed in lower lying areas.

Beaches:

- Ongoing routine and episodic (Super Storm Sandy) erosion and loss of beaches and dunes and potential impacts on attraction for visitors and tourists (i.e. Town Beach).

Trees and Forests:

- Increasing impacts to tree health from pests and pathogens resulting in large population of dead and damaged standing trees that pose risks to power lines and increase blockage of roads during emergencies.
- Aging street trees with many over 100 years old increasing risk.

Salt Marsh:

- Loss of critical natural infrastructure that protects people and property.

Current Strengths and Assets

Just as certain locations, resources, and populations in Bristol stand out as particularly vulnerable to the effects of hazards and climate change, other features are notable as affirmative assets to Bristol's resilience efforts. Workshop participants identified the following items as their community's key strengths, and expressed interest in using them as the core of future resilience building interventions.

- Clearly, the responsive and committed leadership exhibited by officials and staff is a very appreciated strength within Bristol. Ongoing collaboration between the Town, business community, faith-based organizations, NGOs, Roger Williams University, adjoining municipalities, and state-level organizations, among others on priorities identified will help advance comprehensive, cost-effective, community resilience building actions.
- The Town has highly experienced staff with access to adequate resources for most emergency situations. The coordination amongst various departments including leadership, Police, Fire, and EMS was cited as a highly valued community strength despite the ongoing need to maintain volunteers over time.
- Presence of Bristol Citizen Emergency Response Team (CERT), which can help disseminate information to citizens and identify transportation and mobility resources.
- Solid emergency management services including good communications system, emergency shelters, heating and cooling facilities, and vehicles able to transport residents to facilities—reflects the Town's strong emphasis on a preparedness culture.
- Town's geographic location, including its location on a peninsula with two access points and the municipality's direct access to harbor and coastal areas.
- Numerous public amenities and spaces improve residents' quality of life, including Colt State Park, smaller neighborhood parks, and the walkable downtown area.
- Roger Williams University, which partners with the Town in public health and project-based assistance programs and draws students and families into the Town.
- Existing educational programs, such as homeowner outreach on floodplain management and school programs focused on aspects of being a coastal community.
- Recent investments in resilience include efforts to mitigate the effects of sea level rise, projects completed on Tanyard Brook, and the Prudence Island dock repair.

Recommendations to Improve Resilience

A common thread throughout the workshop discussions was the recognition that Bristol needs to be better prepared through longer-term, community-based, contingency planning across all areas of concern. This need and additional highlights surfaced and prioritized by the workshop participants are provided below across several sub-categories including capacity building, projects, plans/preparedness/studies/outreach, and policy. Mitigation actions from Bristol NHMP (2016) are provided in Appendix.

The workshop participants collectively identified several key priority areas stated here and reflected in the lists of potential actions below:

- Infrastructure improvements to wastewater treatment system and facilities, storm-water management systems, and the transmission of drinking water supply.
- Watershed and groundwater management and prioritization of ecological assets.
- Emergency preparedness, communications, sheltering, and continuation of services.

Higher Priority Actions

Capacity Building:

- Create a Neighborhood Resilience Plan to improve sustainability and resiliency in individual neighborhoods, including infrastructure and development improvements.
- Leverage opportunities to collaborate on a regional basis across the East Bay.

Projects:

- Create redundancy in water transmission line for fire suppression and drinking water supply to minimize risks of damage to the only transmission line for Bristol.
- Address flooding in key areas through completing Hazard Mitigation Plan projects.
- Identify places and projects to accommodate flooding and/or suitable for green stormwater infrastructure as wells as enhancing the quality of life for residents.
- Address how sea level rise in the Harbor during storms contributes to flooding under various scenarios with and without storm surge from hurricanes.
- Protect and flood-proof the wastewater treatment plant.
- Conduct town-wide drainage improvement program including green solutions.

Higher Priority Actions (cont'd)

Projects:

(Credit: Patch

- Complete Tanyard Brook flood mitigation project.
- Continue implementing the Silver Creek Stormwater Plan, and work with private property owners on stormwater management interventions.
- Elevate the Wastewater Treatment Facility pump stations, slipline pipes, and conduct UV treatment study to increase resiliency in the Wastewater Treatment Facility system.
- Improve and strengthen access to the harbor, parks, and boat ramps with rights of way safety enhancements.
- Implement end of road retrofits and pavement removal in prioritized areas.

Plans/Preparedness/Studies/Outreach:

- Solidify capital plan, better articulate capital priorities, and identify funding.
- Revisit and update shelter and evacuation plan with emphasis on protecting vulnerable populations and ensuring sufficient sheltering exists for short & long-term stays.
- Conduct watershed studies as part of town-wide drainage improvement program.
- Conduct high groundwater study to determine areas of highest risk, and compile best management practices from other municipalities with high groundwater tables.
- Seek to limit structures with foundations in groundwater.
- Continue to require individual property indemnities so future builders, not the Town, are responsible for basement flooding activities and associated costs.

Policy:

- Recognize economic value of environmental assets and prioritize their protection through stricter development regulations and capital improvement projects.

Community Resilience Building Workshop Recommendations

Priority Actions

Capacity Building:

- Create plan to aid and help restart businesses immediately after future major storm events.
- Improve coordination with outside agencies (i.e. RIDOT, federal agencies, BCWA) to resolve mutual aid issues and increase efficiency.
- Look to partner with State and other municipalities to integrate historic properties and cultural resources into hazard mitigation planning and ongoing responses to risks from sea level rise.

Projects:

- Address vulnerabilities in the sea wall by Poppasquash Road and current inundation at above-average high tides.
- Repair sea wall at Walley Beach.
- Revisit the construction of the Silver Creek Bridge with long-term sea level rise built into the design and engineering solutions.
- Reduce pollution in the Harbor to ensure long-term resilience of this resource.
- Incorporate resilience designs to reduce vulnerability of structures in coastal downtown/historic area to better withstand future climate impacts.
- Initiate or continue flood mitigation projects within the Silver Creek watershed (i.e. golf course, Tupelo Street).
- Install green stormwater infrastructure at Police Station parking lot.
- Restore wetland habitat at the golf course to increase flood storage.
- Implement Mt. Hope High School drainage master plan.
- Increase the resiliency of Independence Park boat ramp.
- Continue to plant trees in Wood Street Neighborhood to protect elderly population from heat, and expand the current tree canopy.

Community Resilience Building Workshop Recommendations

Priority Actions (cont'd)

***Projects*:**

- Initiate stream restoration project to increase flood storage capacity along the East Branch of Silver Creek (i.e. Mt. Hope High School, Leila Jean Drive, Chestnut Street).
- Expand green stormwater infrastructure projects in parking lots and front yards.
- Disconnect property owners with foundations below the groundwater table from sub-basin sewage system. Find additional ways to enact preventive measures to mitigate sewer discharge into the Bay.
- Construct sea wall at Harbor to give Town more time to prepare for climate change.
- Expand bicycle infrastructure and sidewalks to promote health and alternative transportation, while encouraging residents to use sustainable transportation methods.

***Plans/Preparedness/Studies/Outreach*:**

- Consider enacting policies mandating that buildings and homes below the groundwater level have backup power installed.
- Consider establishing a stormwater utility with dedicated funds to address flooding using a variety of approaches including green stormwater infrastructure.
- Improve outreach with senior citizens, particularly those in private facilities.
- Pursue more communication and planning with Roger Williams University.
- Evaluate the impact of Bristol's geography on transportation, evacuation routes, and utilities in preparation for future storm events
- Evaluate how the closure of one of the Town's two major roadways affects evacuation routes.
- Improve sheltering capacity throughout Bristol.

(Credit: Pinterest)

Community Resilience Building Workshop Recommendations

Priority Actions (cont'd)

Plans/Preparedness/Studies/Outreach:

- Continue working with Save the Bay to monitor stormwater impact.
- Continue use of trees in stormwater mitigation.
- Identify, prioritize, and address the Harbor's vulnerabilities.
- Continue implementing best management practices and low-impact development.
- Expand financial assistance and support for business.
- Review town-wide Hazard Mitigation Plan and reevaluate prioritization of projects across neighborhoods.
- Identify both areas susceptible to and area that can accommodate flooding to determine where flood management could be bolstered.
- Educate university students about the challenges of a coastal community and provide opportunities for them to help develop long term solutions.
- Review watershed studies to identify areas for enhanced flood storage capacity and explore opportunities for parcel acquisition, if appropriate.
- Examine the potential impact of Silver Creek flooding.
- Consider installing a hurricane barrier within the Harbor.
- Mitigate or address repetitive loss properties through acquisition, demolition, or elevation of properties.
- Evaluate potential for spaces to be developed into stormwater flooding basin areas (i.e. land around Silver Creek, swale areas).
- Install green stormwater infrastructure at Gooding Plaza shopping center.
- Enforce parking regulations near water to help fishermen with access.
- Conduct study of possible protections for historic properties given sea level rise.
- Study cost, impact, and effectiveness of armoring/burying utility lines.
- Evaluate how to maintain access to critical medical services if main roadways are impassable.

Community Resilience Building Workshop Recommendations

Priority Actions (cont'd)

Plans/Preparedness/Studies/Outreach:

- Create emergency shelter for residents with pets.
- Plan for redundant infrastructure that can eventually be phased out.

Policy:

- Allocate more funding towards tree trimming and protecting power lines.
- Ensure that minimizing environmental impact is a priority in every development project.
- Reduce or prohibit use of lawn fertilizer to improve water quality in wetlands, rivers, groundwater, and the Bay.
- Limit new construction in floodplains and areas vulnerable to future sea level rise, particularly in the historic district.
- Disclose risk and costs of flooding and pumping to applicants (for permits, etc.) before building begins.
- Restrict the overuse of road salt on Town roads.
- Facilitate solar power permitting.
- Strengthen wetland and floodplain permitting standards.
- Strengthen envelope and roofing codes to improve overall resilience of structures.
- Expand high pressure zone via Bristol County Water Authority.

CRB Workshop Participants: Department/Organization

Town of Bristol - Town Administration

Town of Bristol - Community Development Department

Town of Bristol - Department of Public Works

Town of Bristol - Fire Department

Town of Bristol - Police Department

Town of Bristol - Planning Department

Town of Bristol - Conservation Commission

Town of Bristol - School District

Town of Bristol - Harbor Department

Town of Bristol - Planning Board

Town of Bristol - Water Pollution Control

Bristol Health Equity Zone

Rhode Island Emergency Management Agency

East Bay Chamber of Commerce

Bristol County Water Authority

East Bay CDC

Save Bristol Harbor

Roger Williams University

Eastern RI Conservation District

Save the Bay

Bristol Historical & Preservation Society

Bristol Core Project Team

Diane Williamson - Director Community Development

Steve Contente - Town Administrator

Online Workshop Facilitation Team

Rhode Island Infrastructure Bank - Shaun O'Rourke (Program Lead & Facilitator)

The Nature Conservancy - Adam Whelchel (Lead Facilitator)

The Nature Conservancy - Sue AnderBois (Lead Coordinator)

The Nature Conservancy - Drew Goldsman (Facilitator)

Department of Environmental Management - Jennifer West (Facilitator)

URI Coastal Resources Center - Teresa Crean (Facilitator)

Scribes - Sabrina Chwalek (TNC), Ella Spungen (TNC), Peter Lees (RIIB), Julia Berkson (RIIB)

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Appendix A

Bristol Natural Hazard Mitigation Plan (2016)
2019 Status Report Action Implementation
Vulnerable Assets & Mitigation Actions
(Section 4.3)

Town of Bristol, Rhode Island

Department of Community Development

10 Court Street
Bristol, RI 02809
www.bristolri.us
401-253-7000

2019 REPORT ON THE STATUS OF IMPLEMENTATION OF ACTIONS IN NATURAL HAZARD MITIGATION PLAN

Meeting held on January 15, 2019 at 11:00 a.m. with the Bristol Local Hazard Mitigation Committee in the Second Floor Conference Room of 9 Court Street, Bristol, Rhode Island.

Present were:
Town Administrator Steven Contente
Director of Community Development Diane M. Williamson
Police Chief Josue Canario
Fire Chief Michael DeMello
Director of the Water Pollution Control Facility Jose DaSilva
Harbor Master Gregg Marsili
Assistant Director of Parks and Recreation Tim Shaw
Principal Planner Edward Tanner

The Committee reviewed the status of the Actions from the Natural Hazard Mitigation Plan, adopted September 28, 2016 and reported the following:

Action #1 – Make Residents Aware of Emergency Response Plan
This action has been implemented through the Code Red program and the ongoing outreach to residents to enroll in this system. The Fire Department publishes and distributes emergency response information annually in May/June before the hurricane season. This information is also posted on the Town of Bristol website and Social media outlets. Additionally, the Fire Department conducts workshops with residents of vulnerable populations and in vulnerable areas. They have had workshops at the Senior Housing locations (Benjamin Church and Franklin Court) and have one planned at North Farm which is a large residential area.

Action #2 – Designate Alternative Evacuation Route for the Poppasquash Area through Colt State Park
This action is in process. The Town is working toward an agreement with RIDEM for access through "Farm Road" including accessibility through the gate and maintenance during winter storms.

Action #3 – Implement Mitigation Incentive Program
This action is ongoing. The Town continues to provide information to contractors and homeowners on the risks of building in hazard – prone areas and the benefits of building and

renovating structures to current standards. The Town continues to seek out grant sources that could provide incentives to implement mitigation measures.

Action #4 – Prepare an "After the Storm Recovery" Plan for the Community
The action is in process and has not yet been completed.

Action #5 – Acquire Properties in the Special Flood Hazard and Repetitive Flood Loss Area
This continues to be a priority for the Town. In 2018, the Town of Bristol received a RIDEM Open Space grant to acquire a parcel in the Special Flood Hazard area of Silver Creek and we are currently in negotiations with the property owner to complete this purchase.

Action #6 – Preserve vacant Open Space within the coastal flood zones
This continues to be a priority for the Town. There were no opportunities within the last year to acquire any such properties; however, the Town continues to monitor opportunities.

Action #7 – Develop a Stand – Alone Environmental and Historic Preservation Plan
The Town is working with the URI Coastal Resource Center who just completed a Coastal Environmental Risk Index looking at structure risk and water depths for the 100-year storm with sea level rise for three areas within the historic district and surrounding properties. With this information, the Town will be seeking funding opportunities to take this information and prepare a plan.

Action #8 – Bury Electrical Wires and other suspended cables
This action has not been completed since it is presently not financially feasible. The Town continues to explore grant opportunities.

Action #9 – Reinforce Wire to Pole Connections
This action has not yet been completed. This was referred to the Bristol Conservation Commission for follow up since the Action also provides protection to the Town's street trees.

Action #10 – Retrofit of paved parking areas within the Tanyard Brook and Silver Creek Watershed
This action is on-going. The Bristol Planning Board recently amended the Subdivision and Development Review Regulations to require Low impact Development Techniques in all applications for subdivision or developments. The Town recently completed the retrofit of the Guitaras School parking lot which is in the Silver Creek Watershed. The Town is also working on implementation of a drainage plan to retrofit the paved parking area at the Bristol Police Department which is in the Tanyard Brook Watershed and is looking to also prepare a drainage plan for future implementation at the Mt. Hope High School which is in the Silver Creek Watershed.

Action #11 – Develop a Shoreline Management Plan
This action is in process. The Town recently partnered with Coastal Resources Management Council for a grant which was successful to retrofit dead end streets that taper into the water. The grant will allow the Town to have engineered plans for the retrofit program that will be eligible for future grant funding to implement.

Action #12 - Public Informational Outreach – Signage
This action is completed. The Town installed signage along major access routes that flood indicating that the area is a flood area. The Town has also been designated a Storm Ready Community and the Fire Chief will be posting signage to that affect.

Action #13 - Upgrade sewer lines where necessary
This action is ongoing as opportunities present. The line on Ferry Road has been upgraded recently to include the installation of laterals brought to the property lines of the shoreline residents on the west side. This will allow the residents the opportunity to connect to the Ferry Road line in the future if the existing sewer lines along the shore become impacted due to climate change. The Fairview sewer line upgrade is currently in construction. In addition, the Town has recently installed generators at 3 sewer pump stations (Tupelo, Peter Road, and Broadcommon Road) with the assistance of a FEMA grant.

Action #14 - Conduct drainage improvements at the Wastewater Treatment Facility
This action has been completed with construction of the drainage line in Fairview Drive.

Action #15 - Inspect and secure the seawall along downtown coastal commercial facilities as necessary
This action is in process. The Town has repaired a portion of the seawall along Rockwell Park. The Town has already acquired the materials and is in the process of obtaining designs and permitting for restoration of the seawalls at Independence Park and Walley Beach. In addition, the Town secured a $1.1 million grant from the Federal Transportation Administration for the repairs to the Prudence Ferry Dock. The plans and permitting for the Ferry Dock repairs have been completed and repairs are expected to be completed in the Fall of 2019.

Action #16 – Establish Fire Lanes in the Mount Hope area
This action has been completed. The National Grid has open lanes for access to their equipment which can also serve as access for the Fire Department if needed.

Action #17 – Upgrade the Quinta Gamelin Community Center to be shelter compliant
This action is completed. The Center has a kitchen. A generator was also recently installed with a FEMA grant.

Action #18 – Promote installation of a check valve/backflow preventer
This action is ongoing as required by the Sewer permitting. All buildings with basement plumbing are required to have Backflow Preventers/Check Valves.

Action #19 – Expand the implementation the Backflow Retrofit Program
All of the residents that were on the list have been completed and no residents are on a wait list. However, we will keep this action item for potential future issues and grant opportunities that may present.

PUBLIC EDUCATION AND AWARENESS

Action #1

Make residents aware of Emergency Response Plan

Steps should be taken to inform residents about which bridges and roads are subject to flooding, as well as about indicators to begin evacuation. Principles of the Emergency Response Plan that are pertinent to given neighborhoods or the population in general should be summarized and distributed. Hazardous locations and warning signs, along with critical phone numbers and evacuation routes, could be conveyed on a calendar, a refrigerator magnet, or some other item commonly displayed in households. Outreach to residents could also be in the form of an annual mailing prior to hurricane season to give information on property protection and preparedness. Public service messages in the newspaper, on the radio, or during public forums may be a sufficient alternative. Include information on how to register for new 'Code Red' program to receive alerts via phone, email, text, etc.

Action #2

Designate Alternative Evacuation Route for the Poppasquash Area through Colt State Park

The Town should seek an agreement from Rhode Island Department of Environmental Management for use of the service road from Poppasquash Road through Colt State Park as a designated evacuation route. This road is located to the west of the former Pearson house and is important for evacuation since it does not cross any waterbodies. Other roads in the Poppasquash area cross bridges at either Mill Gut or Mill Pond Residents should be made aware of this route with signs posted. This is important not only for the residents but for the general public, including tourists, who may be visiting the area.

Action #3

Implement Mitigation Incentive Program

The Building Official will provide information to contractors and homeowners on risks of building in hazard-prone areas and inform builders and homeowners of the benefits of building and renovating structures to current standards. The Town will use FEMA's *Home Builder's Guide to Coastal Construction* (Publication #499), FEMA's *Coastal Construction Manual* , (Publication #55CD Third Edition), *No Adverse Impact (NAI) Coastal Land Management Guidelines* developed by the Association of State Floodplain Managers, *R.I. Coastal Properties Guide*, and other FEMA publications, as applicable.

In addition, the Town will promote and support enforcement of the latest policy revisions relative to climate change and sea level rise and distribute literature related to mitigation techniques including information from the Institute of Business and Home Safety, retrofit methodology (FEMA's library of Technical Bulletins), grant/loan sources, and insurance options.

Consider developing public/private partnership incentives to implement mitigation measures in coordination with local, state, and federal funding opportunities. Incentives could include tax incentives, cost-sharing, and regulatory streamlining or acceleration of the permit process for those who implement mitigation activities.

PROPERTY PROTECTION

Action #4

Prepare an "After the Storm Recovery" Plan for the Community

The Town should utilize the opportunity of a disaster to improve its' disaster resilience. Once critical life and safety issues and vital public services have been addressed and re-established, emphasis should be placed on the long-term recovery of the community, balancing the need to rebuild rapidly and return to normal against the objective of building back better and stronger. Consideration should be given to a 'Regional' approach.

Additional items for consideration as part of the Plan's development include the completion of *Community Assessments* and a *Recovery and Reconstruction Ordinance*. The Bristol Emergency Management Task Force/Certified Floodplain Manager (s) to develop a formalized protocol to complete Community Assessments after an event regarding the shutoff/reconnection of utilities, damage assessments/documentation and Certificate of Occupancy re-instatements. The Town to coordinate with CRMC and Statewide Planning to review the permitting process, develop and adopt an ordinance to streamline the process in the aftermath of a hazard impact including the process to allow homeowners to retrofit structures in order to reduce risk. Formalize the existing process, and also maintain current policy to waive permit fees for building permits to repair storm-damaged properties.

Action #5

Acquire properties in the Special Flood Hazard and Repetitive Flood Loss Areas

Bristol now includes 12 severe repetitive flood loss properties as well as properties subject to periodic flooding within the Tanyard Brook and Silver Creek watershed area. The Town will work with private homeowners in these areas and FEMA to identify an acquisition project (s), obtain approval by the State and FEMA, and seek funding to purchase the property. By purchasing these residential properties, the Town is utilizing an effective program designed to move people and property away from high-risk areas to reduce disaster losses. The buildings are either demolished or relocated, and the land is then restricted to open space, recreation, or wetlands in perpetuity.

Action #6

Preserve vacant open space within the coastal flood zones.

The Open Space Plan identifies areas for acquisition that would not only remove properties from the flood zone, but would also satisfy other community objectives; such as, open space, parks and recreation sites; or, scenic areas. One of the best ways to prevent flood damage is to keep flood-prone areas undeveloped. The Town, working with the Conservation Commission as part of the Open Space Plan implementation, will seek to acquire parcels in risk areas as they become available for acquisition.

Action #7

Develop a stand-alone Environmental and Historic Preservation Plan.

An Environmental and Historic Preservation Plan (EHP) will identify and mitigate potential loss to historic resources associated with natural disasters, primarily threats to sea level rise, subsidence and flooding, particularly in the Bristol Waterfront National Register District. By assessing the significance of cultural resources within the 100-year floodplain boundary and risk from flooding associated with those resources, planning for their preservation will enable the Town to better protect the architectural integrity of the downtown. As a first step, the Town will conduct a comprehensive vulnerability analysis of historic structures to include elevations and vulnerabilities within the first 5 years. The plan should articulate the potential re-use/rehabilitation/relocation potential for historic structures and at-risk properties within the floodplain.

Action #8
Bury electrical wires and other suspended cables

Continue the requirements for subsurface utility lines in new subdivisions. On existing streets in the downtown, the above ground utilities should be placed underground. Although not financially feasible at this time; it should be considered in the future, especially if the Town is eligible for federal disaster assistance after a storm event.

Action #9
Reinforce wire-to-pole connections

While Action #11 above is a long term implementation item, in the short term, the wires on the poles in the downtown area, particularly along Hope Street, should be secured to the poles with "Hendrick's Spacer Cables." These spacer cables make the wires more durable, improve the reliability of service to customers; and protect the health of the street trees, making them less susceptible to storms.

NATURAL RESOURCE PROTECTION

Action #10
Retrofit of paved parking areas within the Tanyard Brook and Silver Creek Watersheds

There may be opportunities to include drainage and/or Low Impact Development techniques, such as infiltration strips and reduced pavement, in existing commercial and municipal parking lots that are being resurfaced. The Town is presently assessing the feasibility of a Stormwater Management Utility District which will consider the development of 'criteria' relative to incentive credits for stormwater improvements across three typologies: retrofit of existing paved surfaces (reductions); new/expansion of parking for commercial sites; and, residential conversions. The Town recently completed the retrofit of the Town Beach parking lot (Clean Water Severe Repetitive Flood Loss loan/RIDEM 319 grant) with the Guiteras School property and the Bristol Police Department site as the next scheduled retrofits.

Action #11
Develop Shoreline Management Plan

Develop a management plan for Bristol's coastal areas that includes the following objectives: improves understanding of coastal processes; predicts the likely future evolution of the coast; identifies all the assets within the area covered by the plan likely to be affected by coastal change; identifies the need for regional or site specific research and investigations; and, identifies the various policies/procedures for hazard mitigation remediation projects. As a first step, the Town will develop and prioritize a functional 'retrofit program' for dead-end streets that taper off into the water. Consideration should be given to a 'Regional' approach.

STRUCTURAL PROJECTS

Action #12
Public Information, Outreach – Signage

Post signs that indicate where major access routes are and areas where early evacuation is necessary. This is important not only for the residents but for the general public, including tourists, who may be visiting the area.

Action #13

Upgrade sewer lines where necessary

A recent Sewer System Evaluation Study has found areas in town with old, cracked, damaged sewer pipes. The age of some pipes is in excess of 75+ years. The cracked, damaged pipes allow ground water to enter the sewer system increasing wastewater flows in excess of the design of the sewer system. By relining/replacing pipes will reduce infiltration, preventing sewer surcharges, overflows, blockages and backups. The Town continues work currently underway in the Tanyard Brook area. The Downtown area has been completed (Franklin St. to the south/business area), while the Tanyard Brook area is currently underway (pilot program).

Due to the regulating agencies (RI DEM and EPA), the Town must project and plan for the future some ten to twenty years forward. The Town's operating permit is often the driving force dependent upon how stringent the parameters are. The Town has completed a pilot program to remove sump pump discharges in the eastern Annawamscutt Avenue area at the cost of $1 million dollars, and is currently awaiting the collection of flow data from several rain events to determine the cost effectiveness of this project. The primary purpose for the project was EPA's mandate to reduce the amount of Inflow and Infiltration (I&I) experienced with storm events. Once the data has been collected and analyzed, the results will determine if the Town continues forward with similar projects, or if the EPA will request the construction of underground storage bypass areas.

Action #14

Conduct drainage improvements at the Wastewater Treatment Facility

Drainage improvements completed in 2012 (new drainage inlet structure connected to converted stormwater drain) has reduced overland flooding at the WWTF. Complementing this, the Town continues to replace Rotating Biological Contactors, elevating their drive motors 2.5 feet higher to ensure more reliable operation and treatment if flooding occurs. The Town is also moving forward to implement necessary drainage improvements (construction of a new drain line, concurrent with a sewer repair project) to keep the WWTF from flooding, which, as a result will also improve drainage along Fairview Drive.

Action #15

Inspect and secure the seawall along downtown coastal commercial facilities, as necessary

The stability of the seawall at Independence Park, Walley Beach, the Armory Building, and Prudence Island Ferry Dock should be evaluated. Retrofits should be made to withstand a 20-to 50-year storm, in addition to the impacts of projected sea level rise.

Appendix B

Bristol

Map Resource Packet*

Used During

Workshop

***Gathered from Local Hazard Mitigation Plan (July 2016) & Comprehensive Plan (Jan 2017)**

Figure 6. FEMA Special Flood Hazard Area (SFHA) zones within RI – Source RI Hazard Mitigation Plan

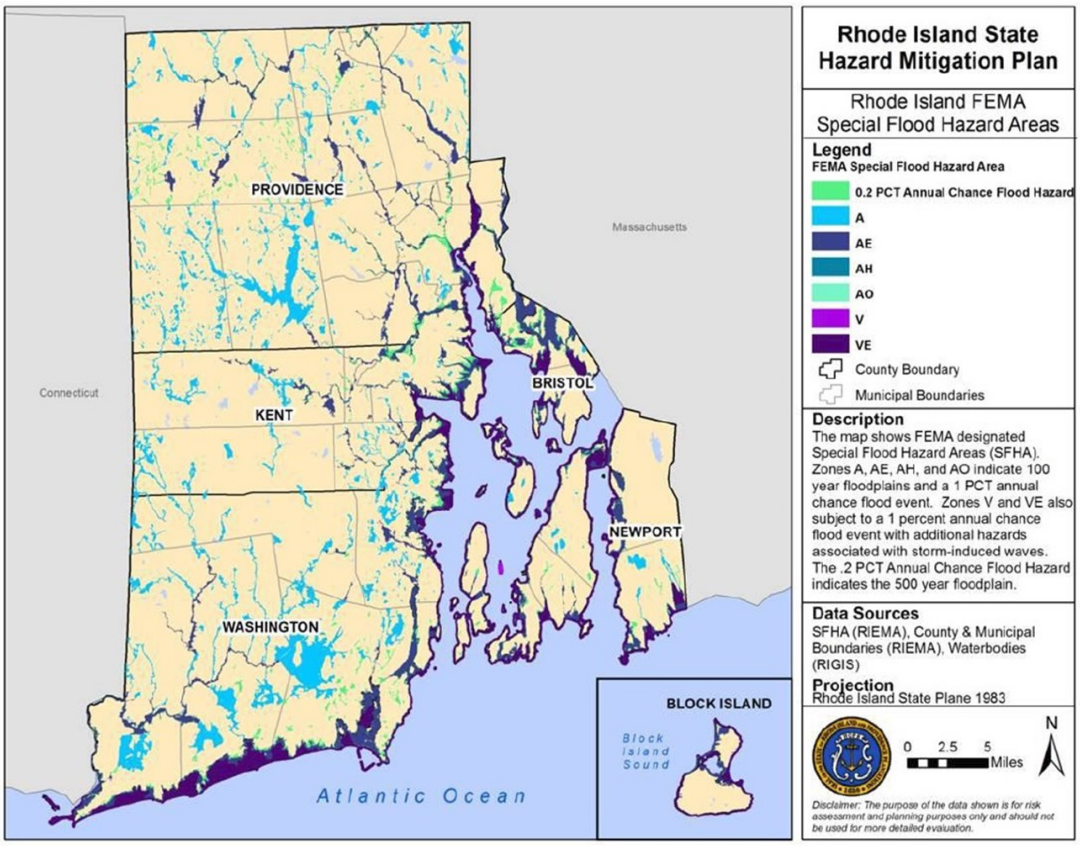
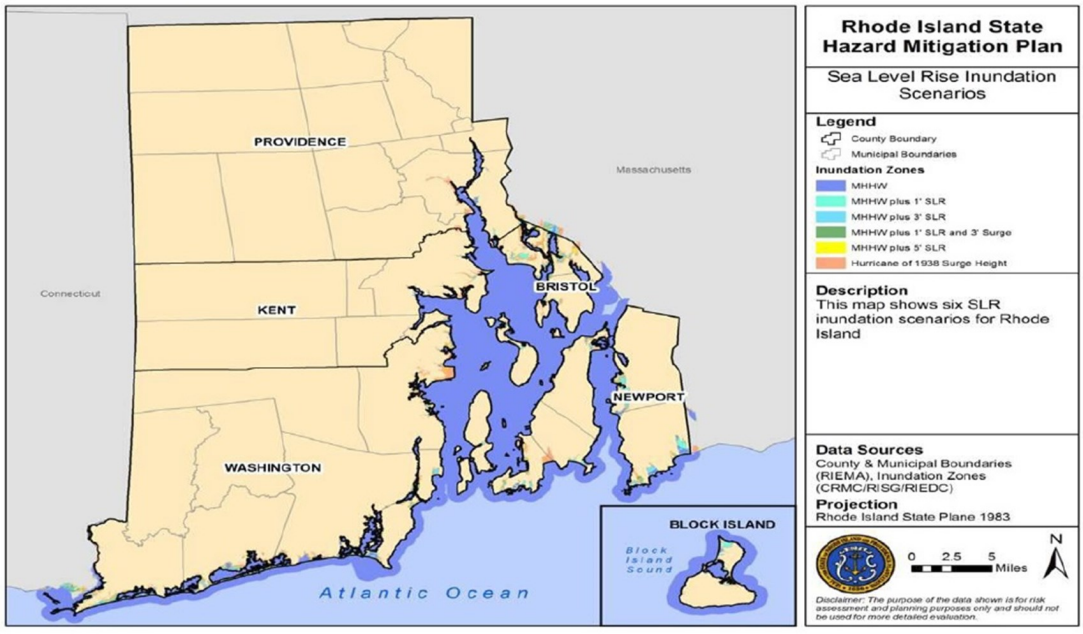
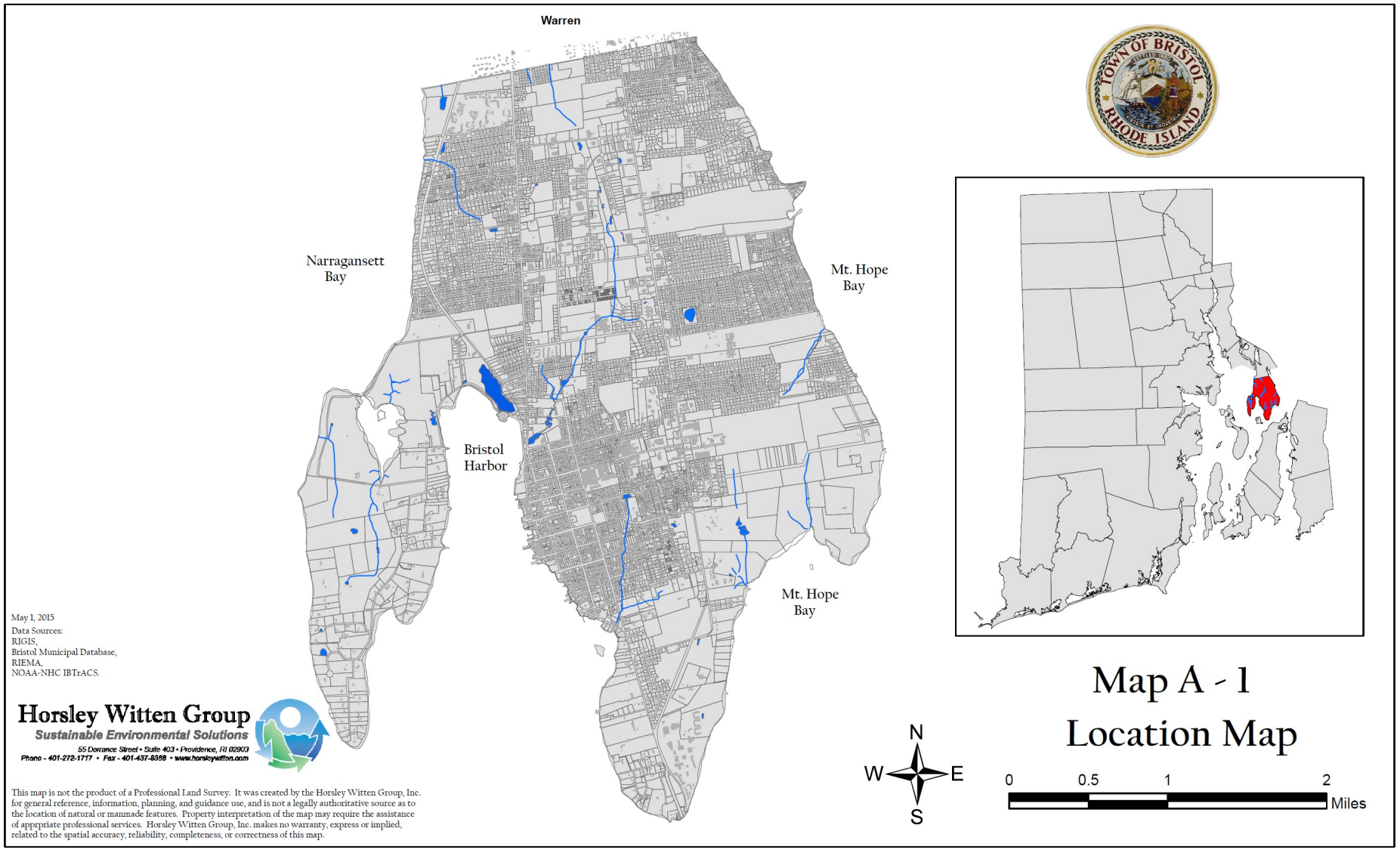


Figure 7 – Sea Level Rise Inundation Scenarios.





Map A - 1
Location Map

May 1, 2015

Data Sources:
RIGIS,
Bristol Municipal Database,
RIEMA,
NOAA-NHC IBTrACS.

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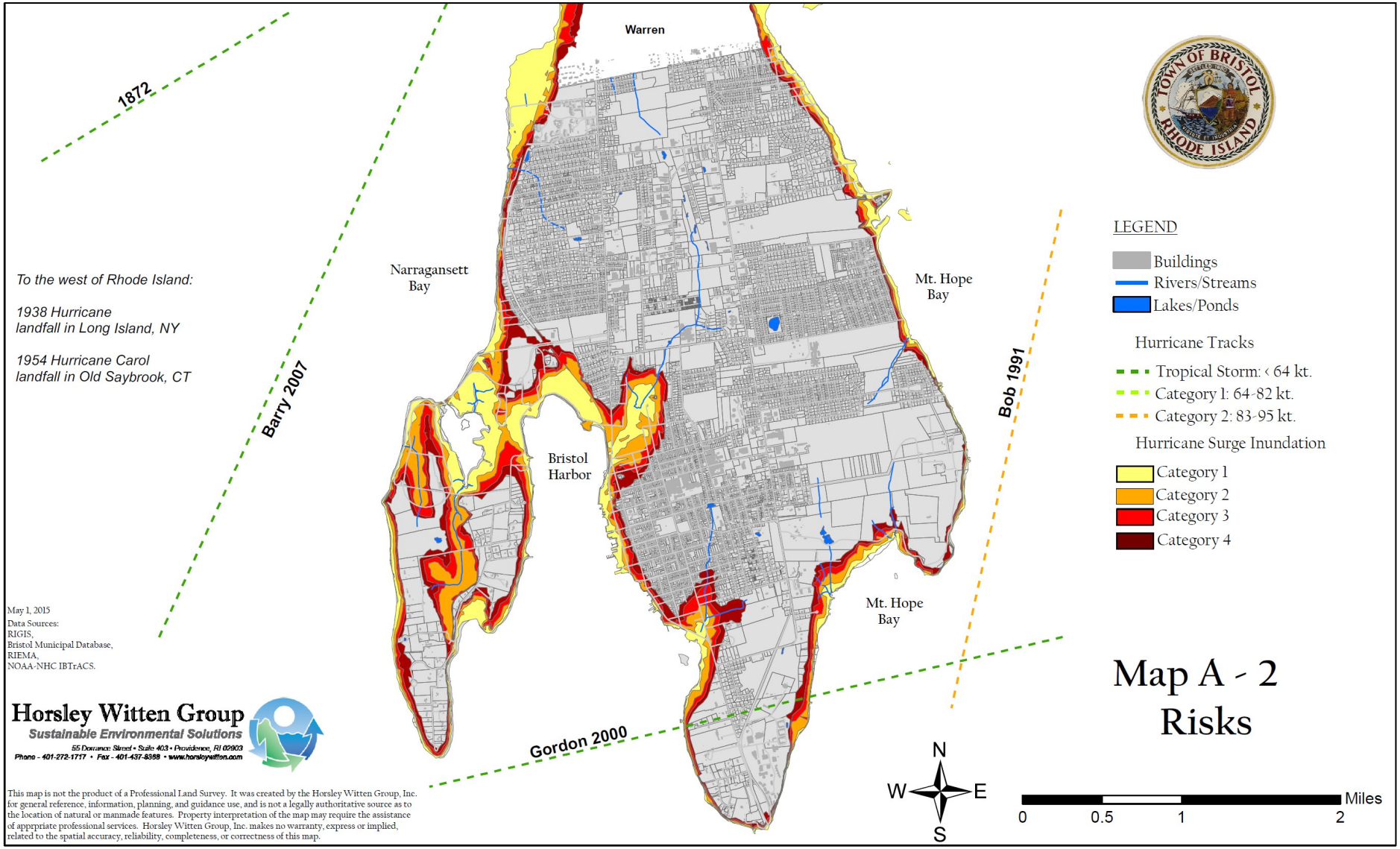
Phone - 401-272-1717 • Fax - 401-437-8368 • www.horsleywitten.com


Warren
1872
Barry 2007
Bob 1991
Gordon 2000
Narragansett Bay
Mt. Hope Bay
Bristol Harbor
Mt. Hope Bay
To the west of Rhode Island:
1938 Hurricane landfall in Long Island, NY
1954 Hurricane Carol landfall in Old Saybrook, CT
LEGEND
Buildings
Rivers/Streams
Lakes/Ponds
Hurricane Tracks
Tropical Storm: < 64 kt.
Category 1: 64-82 kt.
Category 2: 83-95 kt.
Hurricane Surge Inundation
Category 1
Category 2
Category 3
Category 4
N
W
E
S
Miles
0
0.5
1
2
Map A - 2
Risks
May 1, 2015
Data Sources:
RIGIS,
Bristol Municipal Database,
RIEMA,
NOAA-NHC IBTrACS.
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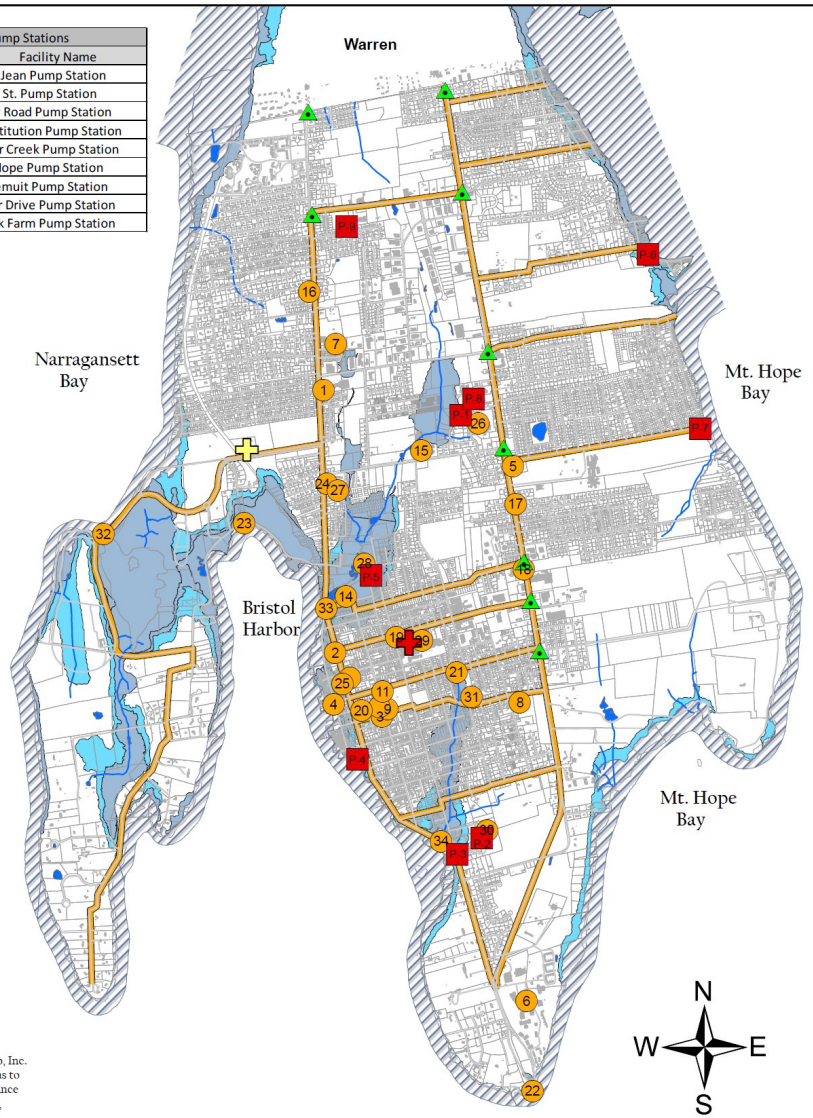
Critical Facilities	
Site ID	Facility Name
1	Bristol Fire Department (400 Hope St.)
2	Bristol Fire Department (Franklin/High St.)
3	Bristol Fire Department (Church St.)
4	Bristol Fire Department (193 Thames St.)
5	Bristol Fire Department/EOC (482 Metacom Avenue)
6	Roger Williams University
7	Sea Side Nursery School and Kindergarten
8	Stoney Lane Preschool
9	Byfield School
10	Reynolds School
11	Our Lady of Mt. Carmel School
12	Colt Andrews School
14	Guiteras School
15	Mt. Hope High School
16	Rockwell School
17	Veteran's Home
18	Bristol Police Department
19	DCYF Frame
20	Bristol Town Hall
21	State St. Pond Dam
22	Mt. Hope Bridge
23	Sea Wall at Poppasquash Rd.
24	Bristol Senior Center
25	Rogers Free Library
26	Metacom Manor Health Center
27	Benjamin Church Manor
28	Silver Creek Manor
29	Franklin Court Assisted Living
30	Wastewater Treatment Facility
31	Bristol DPW Facility
32	Mill Pond Bridge
33	Town Bridge
34	Tanyard Brook Crossing

Pump Stations	
Site ID	Facility Name
P-1	Leila Jean Pump Station
P-2	Main St. Pump Station
P-3	Ferry Road Pump Station
P-4	Constitution Pump Station
P-5	Silver Creek Pump Station
P-6	Mt. Hope Pump Station
P-7	Kickemuit Pump Station
P-8	Peter Drive Pump Station
P-9	Brook Farm Pump Station



TOWN OF BRISTOL RHODE ISLAND

LEGEND
- Critical Facilities
- Pump Stations
- Emergency Evacuation Route

FEMA Flood Zones
- AE (100-Year)
- VE (100-Year)
- X500 (500-Year)

- Buildings
- Rivers/Streams
- Lakes/Ponds
- Red Cross Shelter
- Red Cross Shelter (Proposed)
- Traffic Control Point

Map A-3 Critical Facilities

May 1, 2015

Data Sources:
RIGIS,
Bristol Municipal Database,
Bristol Police Department

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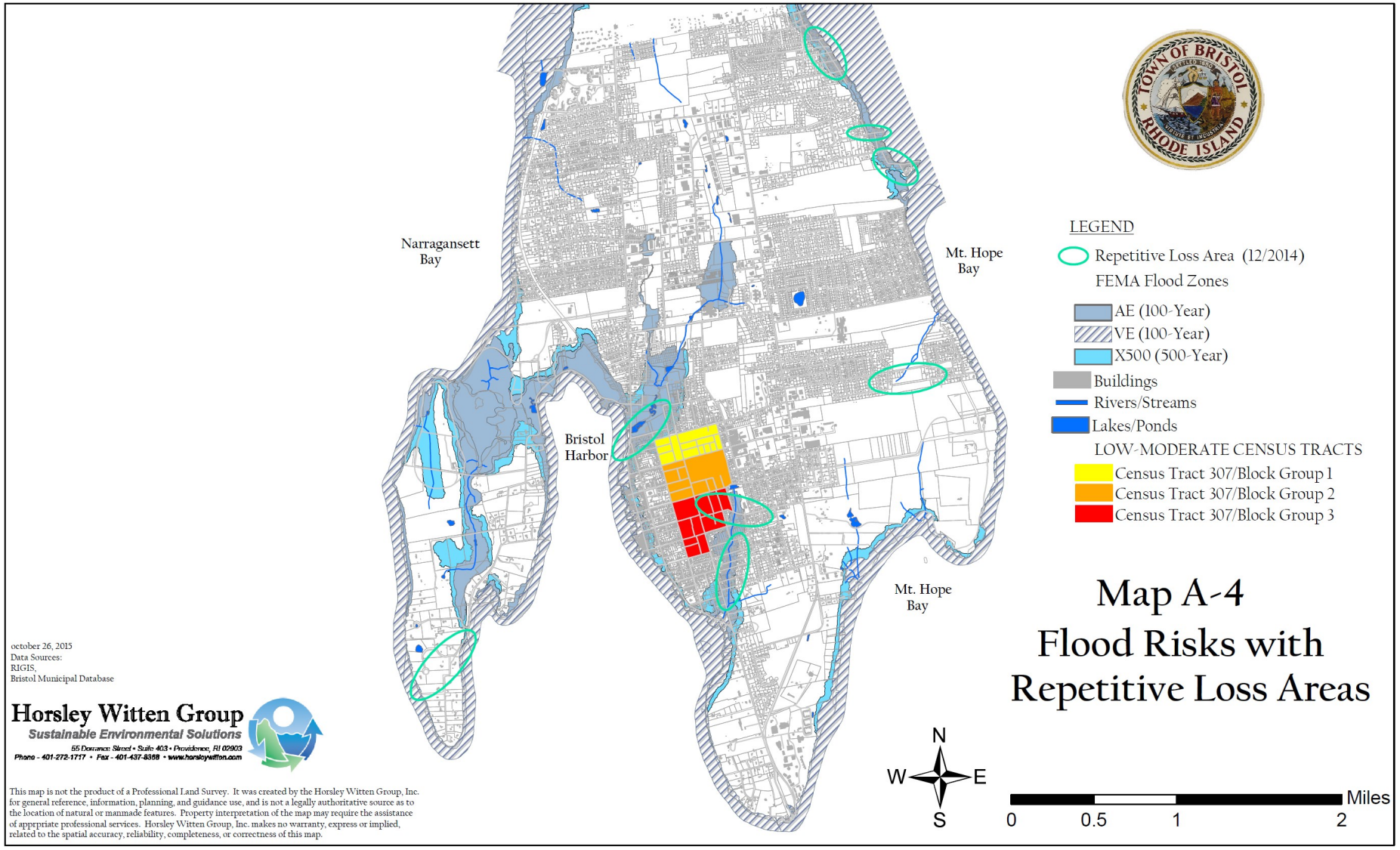
Narragansett Bay
Bristol Harbor
Mt. Hope Bay
Mt. Hope Bay
LEGEND
Repetitive Loss Area (12/2014)
FEMA Flood Zones
AE (100-Year)
VE (100-Year)
X500 (500-Year)
Buildings
Rivers/Streams
Lakes/Ponds
LOW-MODERATE CENSUS TRACTS
Census Tract 307/Block Group 1
Census Tract 307/Block Group 2
Census Tract 307/Block Group 3
Map A-4
Flood Risks with Repetitive Loss Areas
N
W
E
S
0
0.5
1
2
Miles
october 26, 2015
Data Sources:
RIGIS,
Bristol Municipal Database
Horsley Witten Group
Sustainable Environmental Solutions
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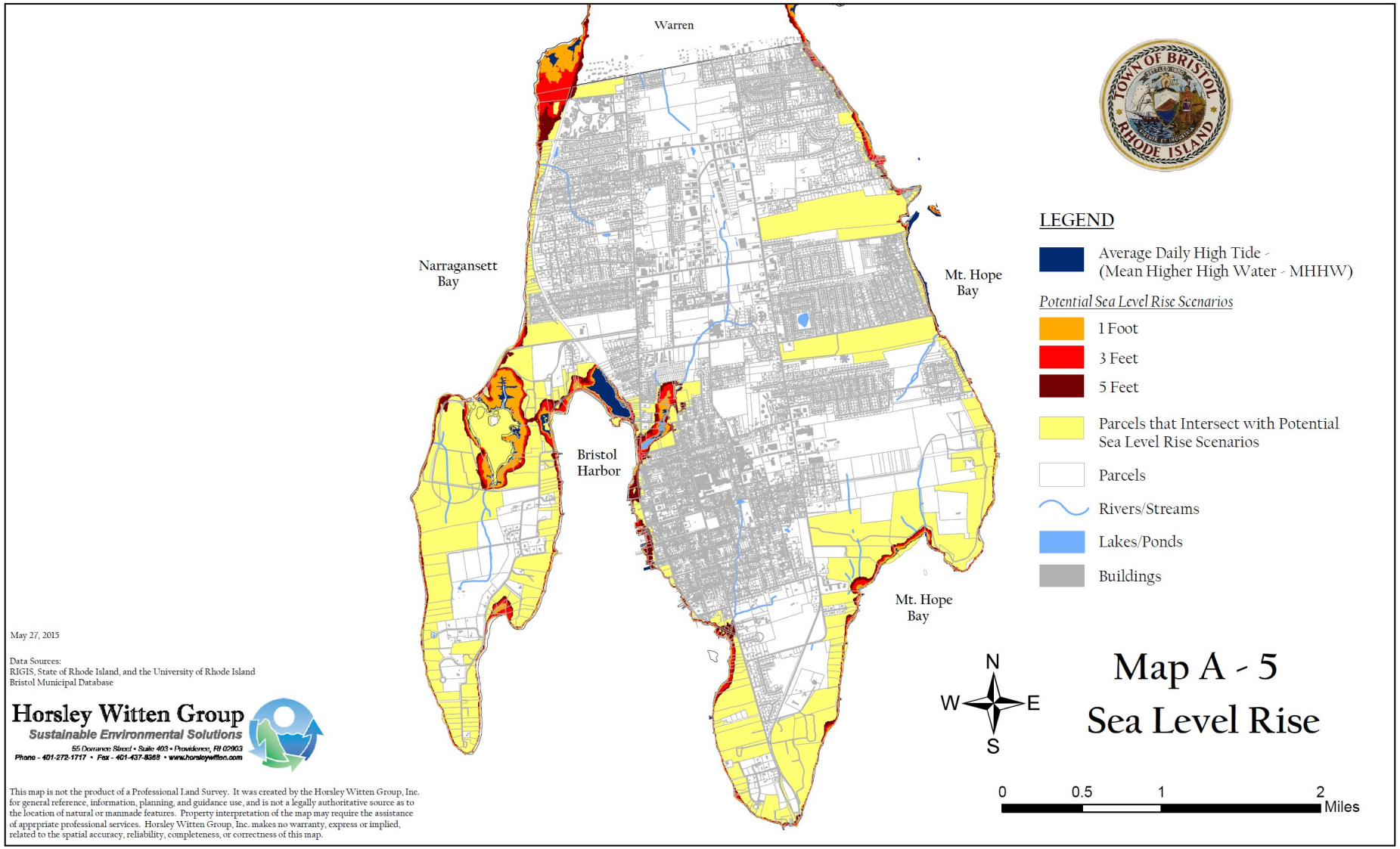
Warren
Narragansett Bay
Mt. Hope Bay
Bristol Harbor
Mt. Hope Bay
TOWN OF BRISTOL
RHODE ISLAND
LEGEND
Average Daily High Tide - (Mean Higher High Water - MHHW)
Potential Sea Level Rise Scenarios
1 Foot
3 Feet
5 Feet
Parcels that Intersect with Potential Sea Level Rise Scenarios
Parcels
Rivers/Streams
Lakes/Ponds
Buildings
N
W
E
S
0
0.5
1
2
Miles
Map A - 5
Sea Level Rise
May 27, 2015
Data Sources:
RIGIS, State of Rhode Island, and the University of Rhode Island
Bristol Municipal Database
Horsley Witten Group
Sustainable Environmental Solutions
55 Dorrance Street • Suite 403 • Providence, RI 02903
Phone - 401-272-1717 • Fax - 401-437-9368 • www.horsleywitten.com
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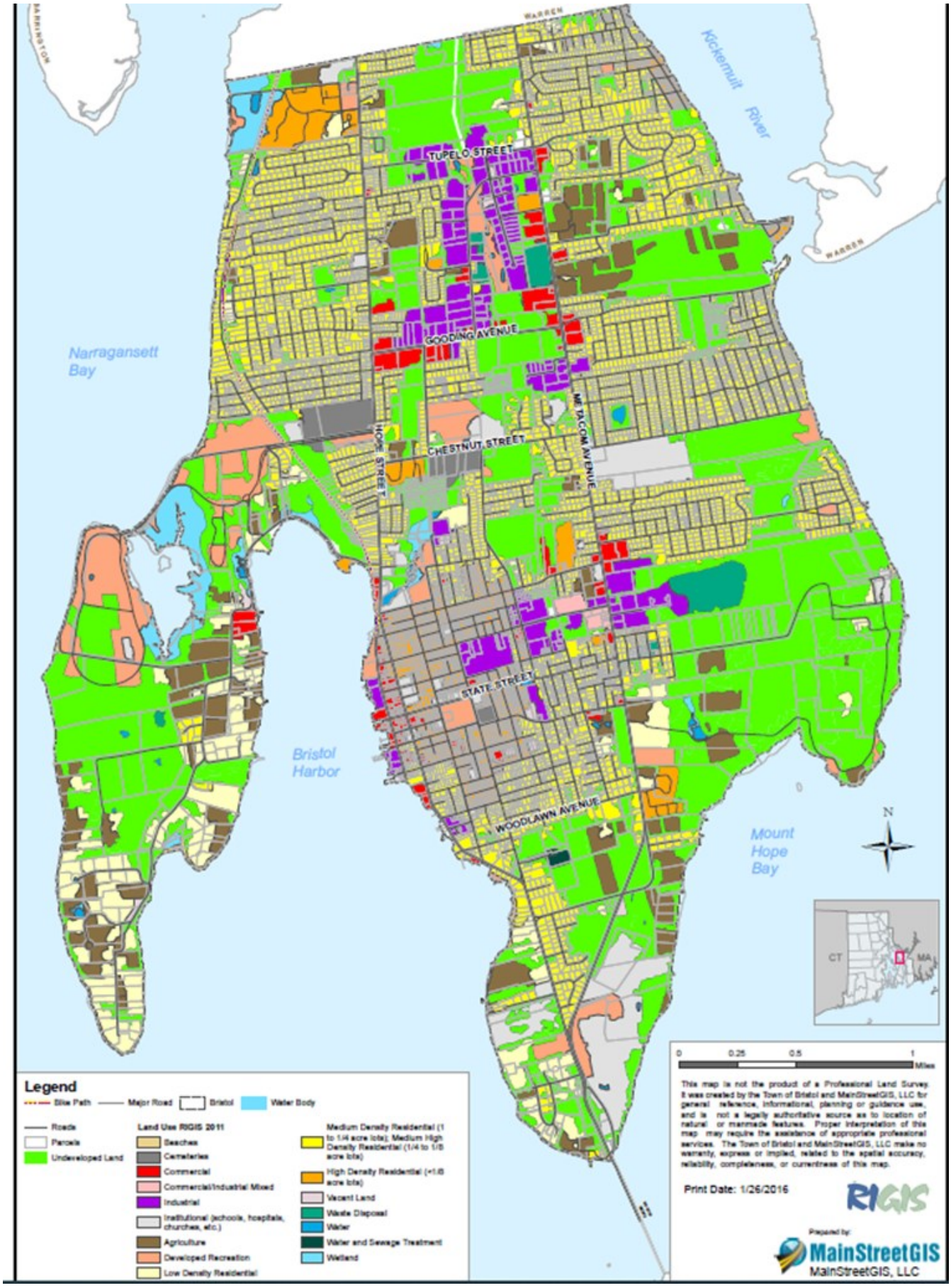
Kickemuit River
Narragansett Bay
Bristol Harbor
Mount Hope Bay
TUPELO STREET
GOODING AVENUE
CHESTNUT STREET
HOPE STREET
METACOM AVENUE
STATE STREET
WOODLAWN AVENUE
WARREN
BARRINGTON
CT
MA
N
Legend
Bike Path
Major Road
Bristol
Water Body
Roads
Parcels
Undeveloped Land
Land Use RIGIS 2011
Beaches
Cemeteries
Commercial
Commercial/Industrial Mixed
Industrial
Institutional (schools, hospitals, churches, etc.)
Agriculture
Developed Recreation
Low Density Residential
Medium Density Residential (1 to 1/4 acre lots); Medium High Density Residential (1/4 to 1/8 acre lots)
High Density Residential (<1/8 acre lots)
Vacant Land
Waste Disposal
Water
Water and Sewage Treatment
Wetland
0
0.25
0.5
1
Miles
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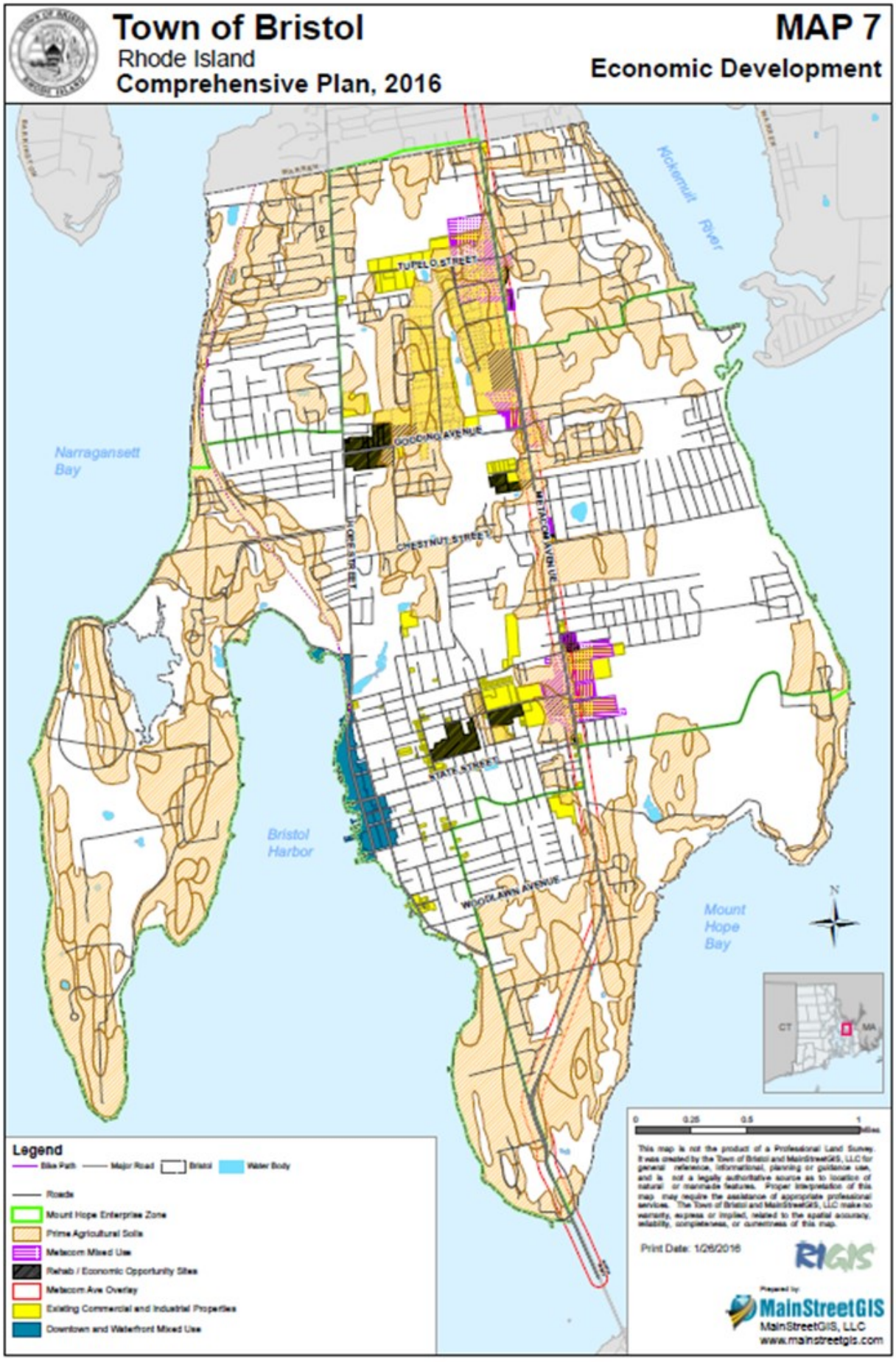
Town of Bristol
Rhode Island
Comprehensive Plan, 2016
MAP 7
Economic Development
Wickenuit River
Narragansett Bay
Bristol Harbor
Mount Hope Bay
TUPELO STREET
GODDING AVENUE
CHESTNUT STREET
METACOM AVENUE
HOPE STREET
STATE STREET
WOODLAWN AVENUE
N
CT
MA
Legend
Bike Path
Major Road
Bristol
Water Body
Roads
Mount Hope Enterprise Zone
Prime Agricultural Soils
Metacom Mixed Use
Rehab / Economic Opportunity Sites
Metacom Ave Overlay
Existing Commercial and Industrial Properties
Downtown and Waterfront Mixed Use
0
0.25
0.5
1
Miles
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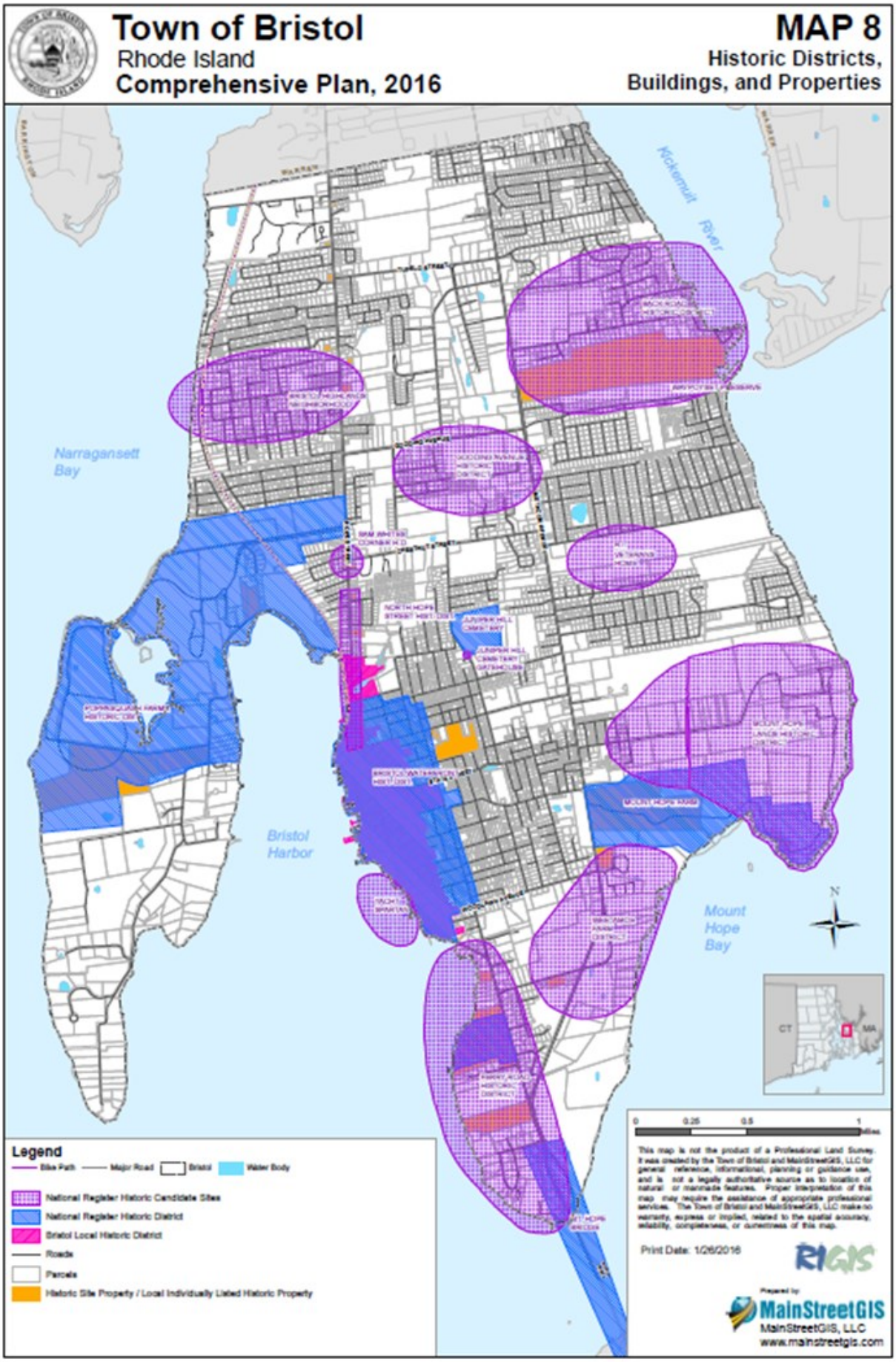
Town of Bristol
Rhode Island
Comprehensive Plan, 2016
MAP 8
Historic Districts, Buildings, and Properties
Narragansett Bay
Bristol Harbor
Mount Hope Bay
Kickemuit River
N
CT
MA
Legend
Bike Path
Major Road
Bristol
Water Body
National Register Historic Candidate Sites
National Register Historic District
Bristol Local Historic District
Roads
Parcels
Historic Site Property / Local Individually Listed Historic Property
0
0.25
0.5
1
miles
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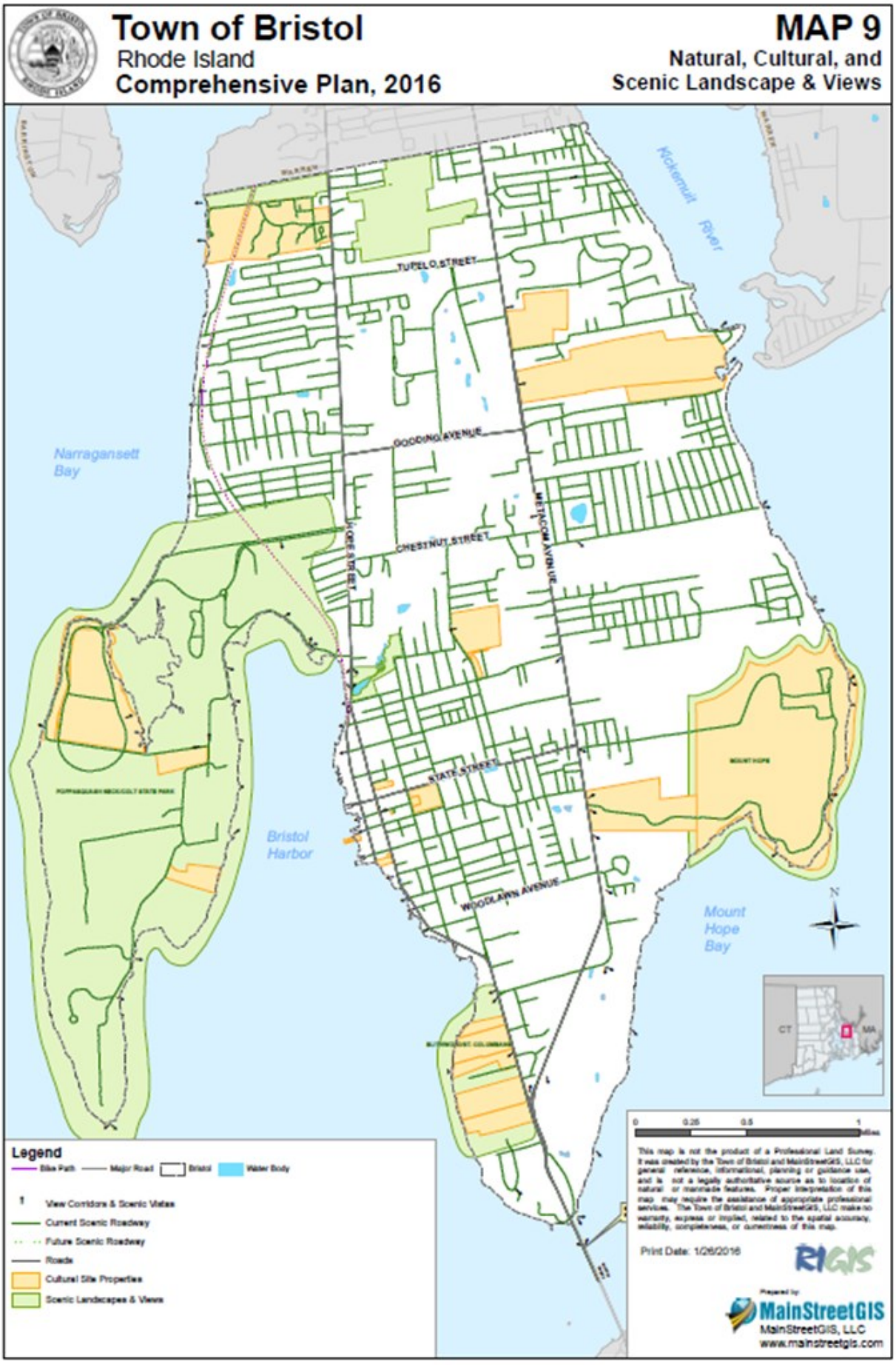
Town of Bristol
Rhode Island
Comprehensive Plan, 2016
MAP 9
Natural, Cultural, and
Scenic Landscape & Views
Kickemuit River
Narragansett Bay
Bristol Harbor
Mount Hope Bay
TUPELO STREET
GOODING AVENUE
CHESTNUT STREET
METACOM AVENUE
STATE STREET
WOOLARN AVENUE
N
CT
MA
Legend
Bike Path
Major Road
Bristol
Water Body
View Corridors & Scenic Vistas
Current Scenic Roadway
Future Scenic Roadway
Roads
Cultural Site Properties
Scenic Landscapes & Views
Print Date: 1/26/2016
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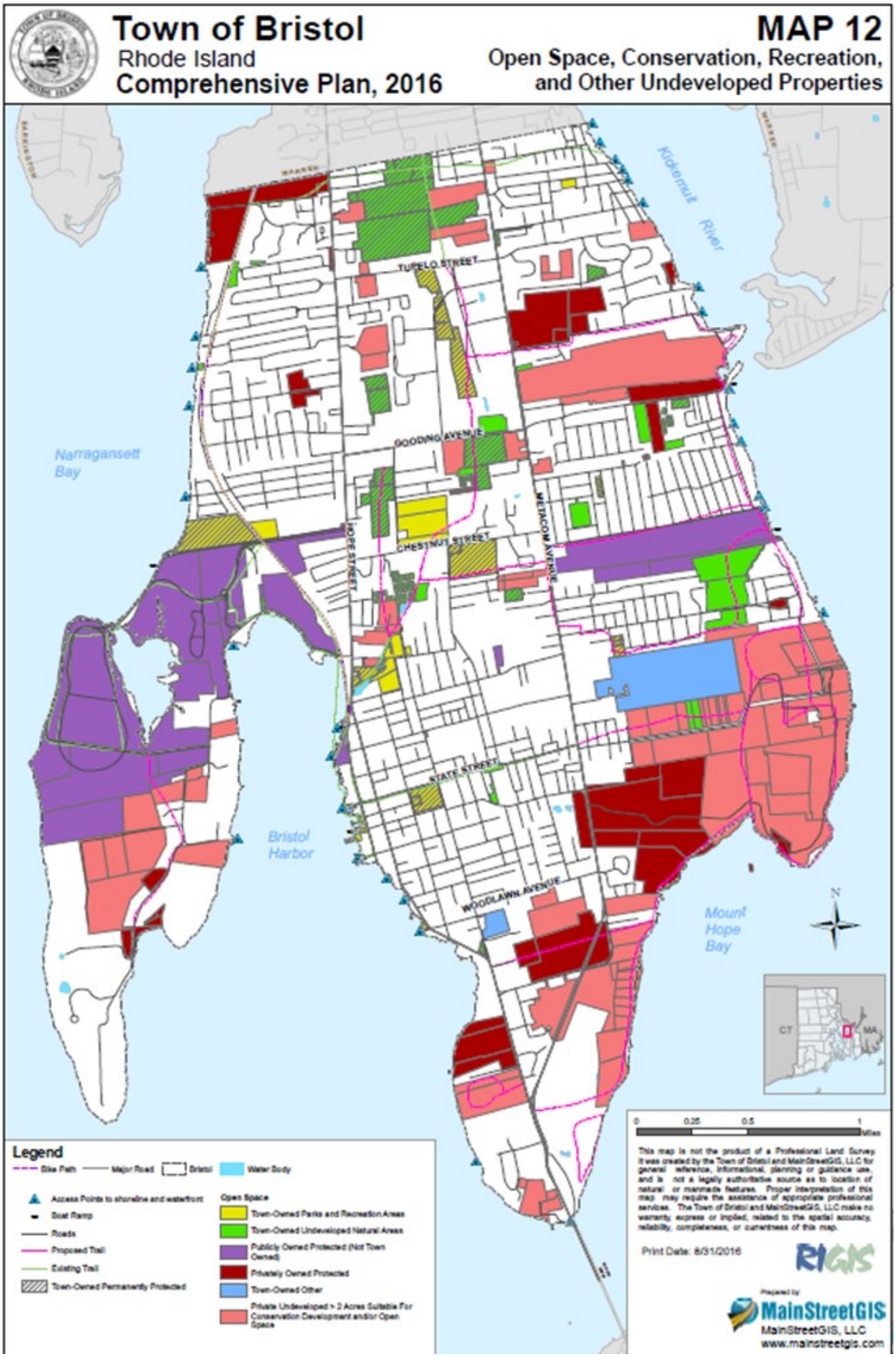
Town of Bristol
Rhode Island
Comprehensive Plan, 2016
MAP 12
Open Space, Conservation, Recreation, and Other Undeveloped Properties
Narragansett Bay
Kickemuit River
Bristol Harbor
Mount Hope Bay
TUPELO STREET
GOODING AVENUE
CHESTNUT STREET
HOPE STREET
METACOM AVENUE
STATE STREET
WOODLAWN AVENUE
N
CT
MA
Legend
Bike Path
Major Road
Bristol
Water Body
Access Points to shoreline and waterfront
Boat Ramp
Roads
Proposed Trail
Existing Trail
Town-Owned Permanently Protected
Open Space
Town-Owned Parks and Recreation Areas
Town-Owned Undeveloped Natural Areas
Publicly Owned Protected (Not Town Owned)
Privately Owned Protected
Town-Owned Other
Private Undeveloped > 2 Acres Suitable For Conservation Development and/or Open Space
0
0.25
0.5
1
Miles
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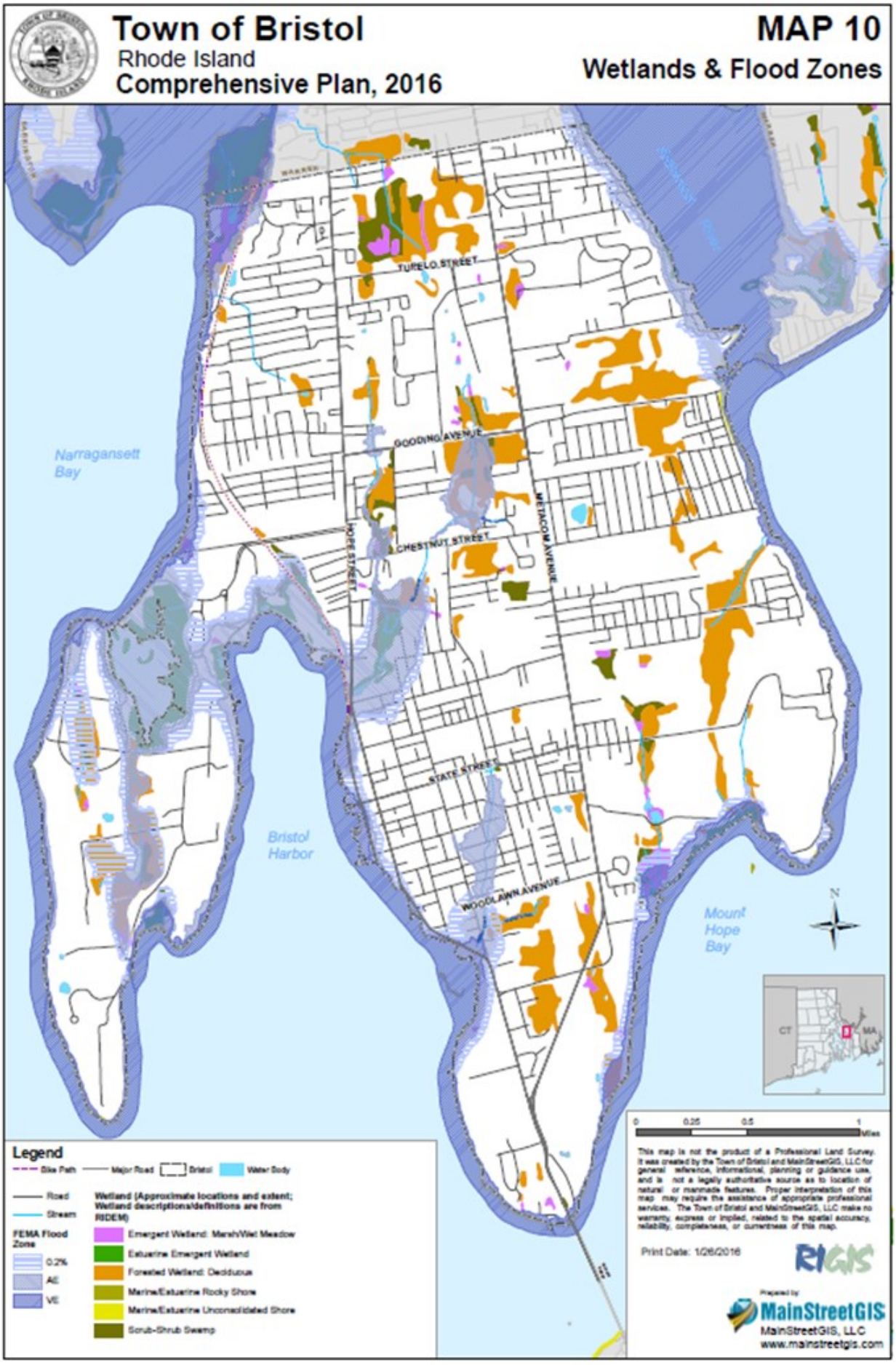
Town of Bristol
Rhode Island
Comprehensive Plan, 2016
MAP 10
Wetlands & Flood Zones
TUPELO STREET
GOODING AVENUE
CHESTNUT STREET
HOPE STREET
METACOM AVENUE
STATE STREET
WOODLAWN AVENUE
Narragansett Bay
Bristol Harbor
Mount Hope Bay
Legend
Bike Path
Major Road
Bristol
Water Body
Road
Stream
FEMA Flood Zone
0.2%
AE
VE
Wetland (Approximate locations and extent; Wetland descriptions/definitions are from RIDEM)
Emergent Wetland: Marsh/Wet Meadow
Estuarine Emergent Wetland
Forested Wetland: Deciduous
Marine/Estuarine Rocky Shore
Marine/Estuarine Unconsolidated Shore
Scrub-Shrub Swamp
CT
MA
Print Date: 1/26/2016
RIGIS
MainStreetGIS
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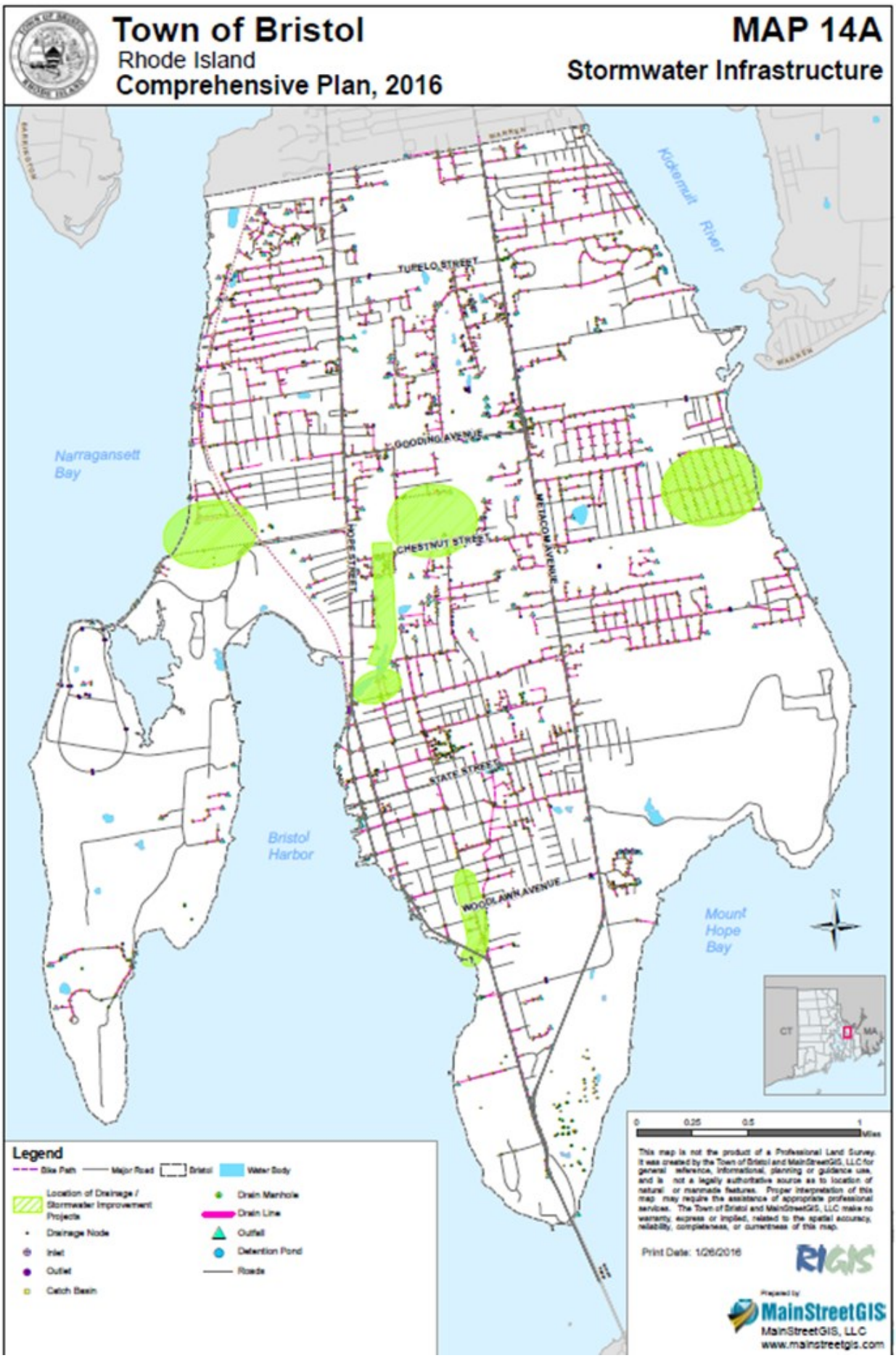
Town of Bristol
Rhode Island
Comprehensive Plan, 2016
MAP 14A
Stormwater Infrastructure
Kickemuit River
Narragansett Bay
Bristol Harbor
Mount Hope Bay
TUPELO STREET
GOODING AVENUE
CHESTNUT STREET
HOPE STREET
METACOM AVENUE
STATE STREET
WOOLAWN AVENUE
Legend
Bike Path
Major Road
Bristol
Water Body
Location of Drainage / Stormwater Improvement Projects
Drainage Node
Inlet
Outfall
Catch Basin
Drain Manhole
Drain Line
Outfall
Detention Pond
Roads
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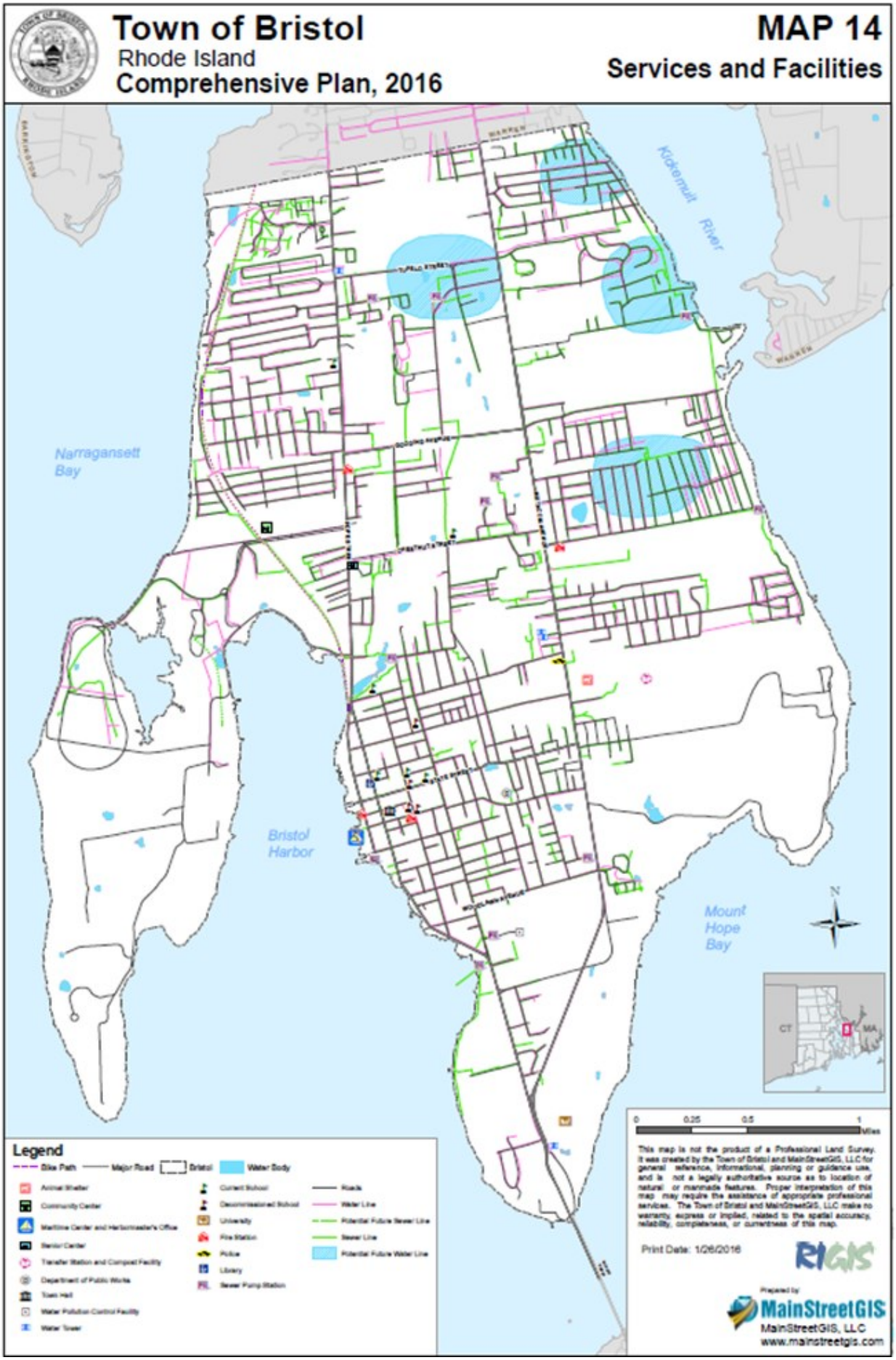
Town of Bristol
Rhode Island
Comprehensive Plan, 2016
MAP 14
Services and Facilities
Kickemuit River
Narragansett Bay
Bristol Harbor
Mount Hope Bay
Legend
Bike Path
Major Road
Bristol
Water Body
Print Date: 1/26/2016
MainStreetGIS
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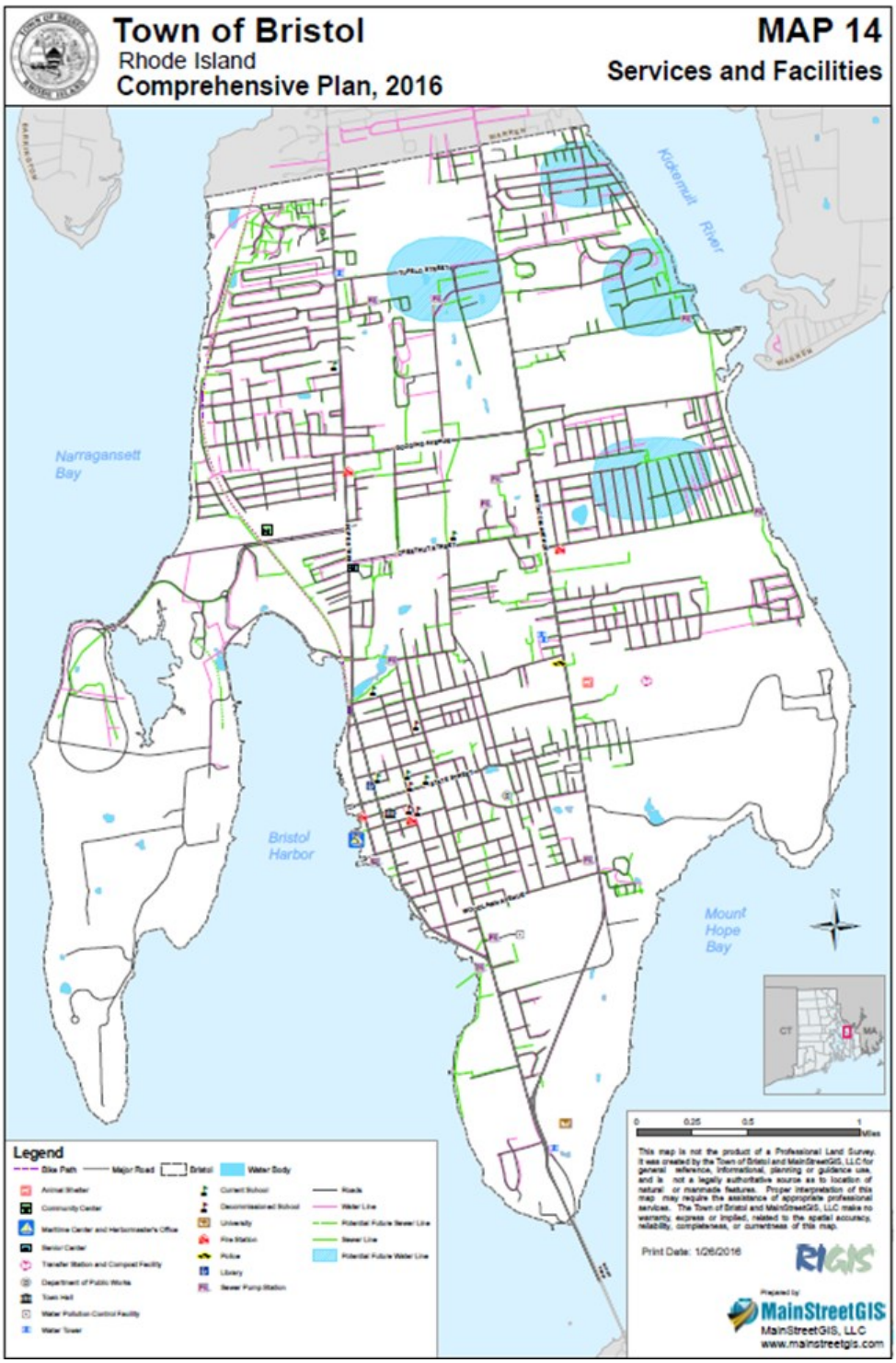
Town of Bristol
Rhode Island
Comprehensive Plan, 2016
MAP 14
Services and Facilities
Narragansett Bay
Bristol Harbor
Mount Hope Bay
Kickemuit River
Legend
Bike Path
Major Road
Bristol
Water Body
Animal Shelter
Community Center
Maritime Center and Harbormaster's Office
Senior Center
Transfer Station and Compost Facility
Department of Public Works
Town Hall
Water Pollution Control Facility
Water Tower
Current School
Decommissioned School
University
Fire Station
Police
Library
Sewer Pump Station
Roads
Water Line
Potential Future Sewer Line
Sewer Line
Potential Future Water Line
Print Date: 1/26/2016
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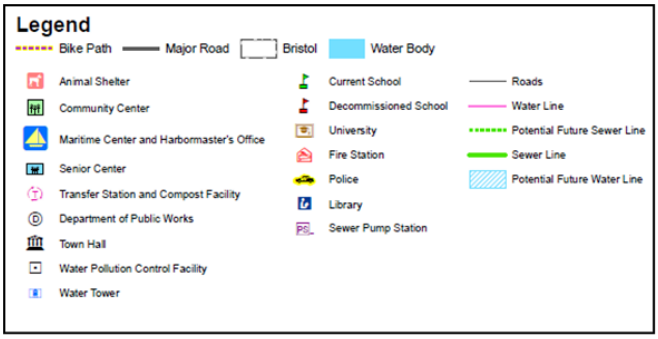
Legend
Bike Path
Major Road
Bristol
Water Body
Animal Shelter
Community Center
Maritime Center and Harbormaster's Office
Senior Center
Transfer Station and Compost Facility
Department of Public Works
Town Hall
Water Pollution Control Facility
Water Tower
Current School
Decommissioned School
University
Fire Station
Police
Library
Sewer Pump Station
Roads
Water Line
Potential Future Sewer Line
Sewer Line
Potential Future Water Line

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